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ACCESSION NUMBER: 1995:261255 BIOSIS
TITLE: Lentzea gen. nov., a new genus of the order Actinomycetales.
AUTHOR(S): Yassin, A. F. (1); Rainey, F. A.; Brzezinka, H.; Jahnke, K.-D.; Weissbrodt, H.; Budzikiewicz, H.; Stackebrandt, E.; Schaal, K. P.
SOURCE: International Journal of Systematic Bacteriology, (1995) Vol. 45, No. 2, pp. 357-363.

2.
ACCESSION NUMBER: 1994:220415 BIOSIS
TITLE: A phylogenetic analysis of the family Pseudonocardiaceae and the genera Actinokineospora and Saccharothrix with 16S rRNA sequences and a proposal to combine the genera Amycolata and Pseudonocardia in an emended genus Pseudonocardia.
AUTHOR(S): Warwick, Simon; Bowen, Timothy; McVeigh, Helen; Embley, T. Martin (1)
SOURCE: International Journal of Systematic Bacteriology, (1994) Vol. 44, No. 2, pp. 293-299.

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Lentzea gen. nov., a New Genus of the Order *Actinomycetales*

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We describe a new genus of mesophilic actinomycetes, for which we propose the name *Lentzea*. The strains of this genus form abundant aerial hyphae that fragment into rod-shaped elements. Whole-cell hydrolysates contain the *meso* isomer of diaminopimelic acid and no characteristic sugar (wall chemotype III). The phospholipid pattern type is type PII (phosphatidylethanolamine is the characteristic phospholipid); the major menaquinone is MK-9. The fatty acid profile comprises saturated, unsaturated, and branched-chain fatty acids of the iso and anteiso types in addition to tuberculostearic acid (10Me-$C_{18:0}$). A 16S ribosomal DNA sequence analysis revealed that the genus *Lentzea* is phylogenically related to the genera *Actinosynnema*, *Saccharothrix*, and *Kutzneria*. The type species of this genus is *Lentzea albidocapillata* sp. nov.; the type strain of this species is strain IMMIB D-958 (= DSM 44073).

Actinomycetes are the causative agents of a variety of diseases of humans and animals, among which actinomycosis, actinomycetoma, and nocardiosis are the most important (32). While actinomycoses are caused by fermentative actinomycetes belonging to the genera *Actinomyces* and *Propionibacterium*, the etiologic agents of actinomycetoma and nocardiosis are various aerobic actinomycetes. Some of the characteristic causative agents of these diseases are members of the sporoactinomycete genera *Actinomadura* (e.g., *Actinomadura madurae* and *Actinomadura pelletieri*) and *Streptomyces* (e.g., *Streptomyces somaliensis*), although these organisms are not the only pathogens that are etiologically involved in the development of human actinomycetoma, which is a localized, chronic, destructive, progressive infection of skin, subcutaneous tissues, and bone. Strains of *Streptomyces albus* have also been isolated from clinical material, such as actinomycosis-like lesions, pulmonary streptotrichosis material, dental caries, blood of patients, and blood of a sick cow (9). *Streptomyces coelicolor* strains were isolated from the skin of 20% of 300 patients checked for dermatomycosis, from tonsils of 25 of 150 patients studied, and from numerous samples of sputum (15). In a study of *Actinomycetales* infections in patients with AIDS, Holtz et al. (16) found that one patient developed a *Streptomyces* lymphadenitis. *Saccharopolyspora* (*Faenia*) *rectivirgula*, *Saccharomonospora viridis*, and *Streptomyces thermohygroscopicus* are thermophilic true actinomycete species that are or may be etiologically involved in farmer's lung or related exogenous hypersensitivity diseases (4). *Streptomyces griseus* has been found to be virulent for laboratory mice when it is inoculated intraperitoneally or intravenously (37). Suspension in mucin results in higher rates of mortality and more extensive lesions and often leads to membranous adhesions of visceral organs. The lesions contain granules of *Streptomyces griseus* (37). *Nocardiopsis dassonvillei*, which resembles the species mentioned above morphologically (11), has also been implicated in human infections, especially respiratory tract infections.

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Early recognition of the actinomycete infections described above is highly dependent on an at least tentative etiological diagnosis based on the results of microbiological tests, since the clinical symptoms may be completely misleading (7). The clinically significant aerobic actinomycetes can usually be identified reliably by using a combination of physiological and chemical techniques (6) which are now widely used in clinical laboratories. By using chemotaxonomic methods for identification of clinical bacterial isolates, one strain, IMMIB D-958^T (T = type strain), was found to have chemotaxonomic characteristics that were different from those of all of the previously described genera belonging to the order *Actinomycetales*. This strain was isolated from a tissue specimen obtained from a 46-year-old woman. In this paper we describe the morphological, chemotaxonomic, physiological, and phylogenetic characteristics of this strain, for which we propose the name *Lentzea albidocapillata*.

MATERIALS AND METHODS

Strain and culture conditions. Strain IMMIB D-958^T (Culture Collection of the Institute of Medical Microbiology and Immunology of the University of Bonn, Bonn, Germany) was isolated from a tissue specimen taken from an abdominal mass in a patient suffering from peritoneal carcinomatosis following carcinoma of the colon. This strain was isolated on a Columbia blood agar plate and was subcultured on brain heart infusion agar (Difco) and glucose-yeast extract-malt extract (GYM) agar, which contained (per 1,000 ml of water) 4.0 g of glucose, 4.0 g of yeast extract, 10.0 g of malt extract, 2.0 g of calcium carbonate, 2.0 g of sodium chloride, and 15.0 g of agar. The other media used in this study were the media recommended for use by the International *Streptomyces* Project (ISP).

Morphology and pigmentation. Strain IMMIB D-958^T was grown on yeast extract-malt extract agar (ISP medium 2), oatmeal agar (ISP medium 3), inorganic salts-starch agar (ISP medium 4), and glycerol-asparagine agar (ISP medium 5) as described by Shirling and Gottlieb (34) and on GYM agar and was examined for pigmentation, production of aerial mycelium, and other morphological characteristics. Cultures were grown for 4 weeks and were observed weekly. Air-dried smears from an ISP medium 4 culture were stained by the Gram method and the Ziehl-Neelsen method in order to determine the Gram reaction and acid fastness, respectively. The micromorphology of the organism was determined by using a culture grown at 37°C for 10 days on ISP medium 4. Electron micrographs were taken with a Zeiss digital scanning electron microscope (model DSM 950).

Physiological characteristics. Peptone-yeast extract-iron agar (ISP medium 6) and tyrosine agar (ISP medium 7) as described by Shirling and Gottlieb (34) were used to determine melanoid pigment production. Tests for decomposition of

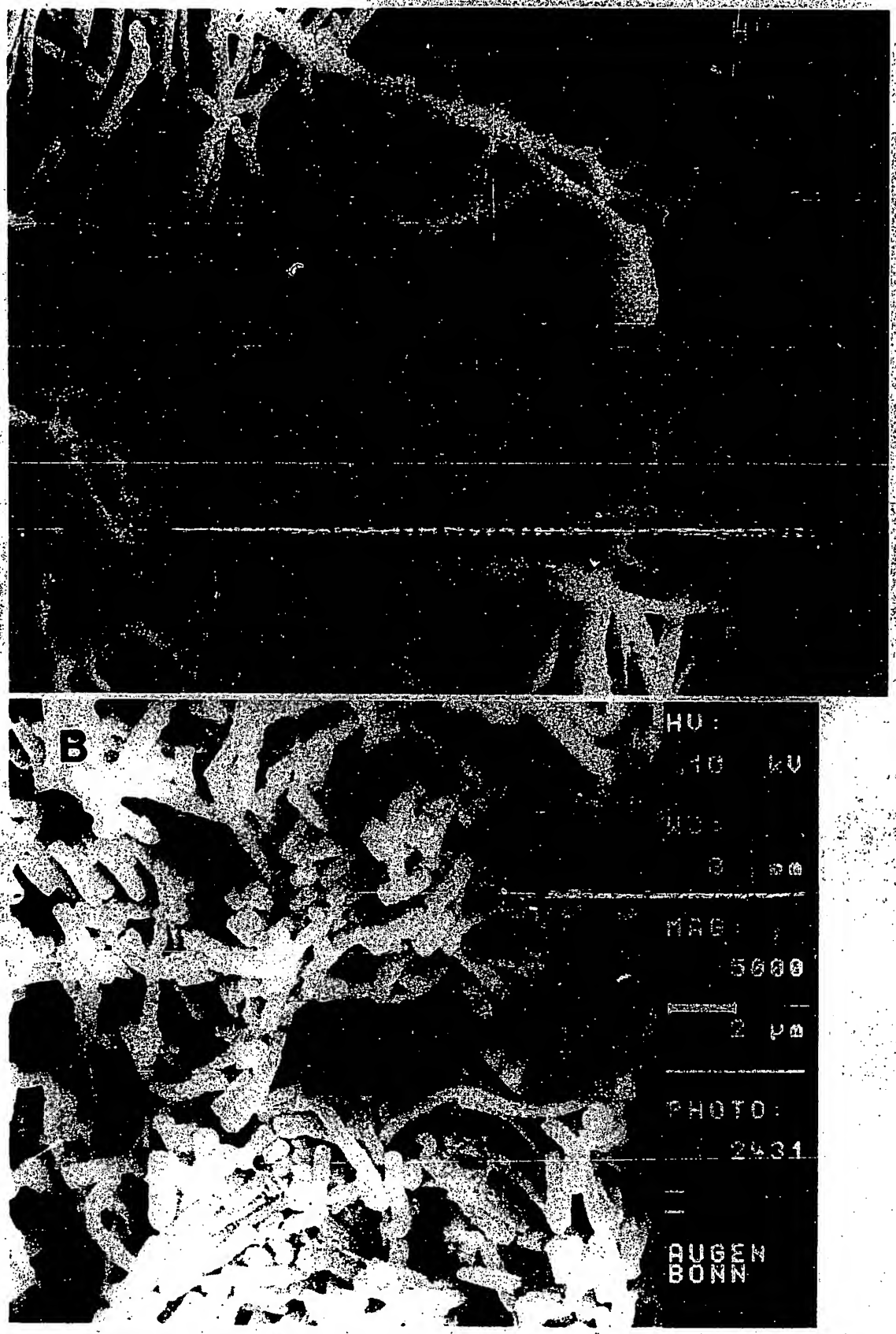

FIG. 1. Scanning electron micrograph of strain IMMIB D-958[T], showing the zig-zag aerial hyphae (A) and rod-shaped fragments of the aerial hyphae (B). The culture was grown on ISP medium 4 for 7 days at 36°C. Bars = 2.0 µm.

TABLE 1. Physiological characteristics of strain IMMIB D-958^T

Characteristic	Strain IMMIB D-958^T
Decomposition of:	
Adenine	−
Hypoxanthine	+
Tyrosine	+
Xanthine	−
Casein	+
Urea	+
Hydrolysis of:	
Esculin	+
Gelatin	−
Elastin	+
Guanine	−
Keratin	−
Testosterone	−
Carbon source assimilation	
L-Arabinose	+
D-Xylose	+
D-Glucose	+
D-Galactose	+
L-Rhamnose	+
Lactose	+
Maltose	+
Raffinose	−
Trehalose	+
Sucrose	+
Cellobiose	+
Melezitose	+
Ribitol	+
meso-Erythritol	−
myo-Inositol	+
Mannitol	+
D-Glucitol	+
Acetate	−
Benzoate	−
Citrate	−
Gluconate	+
Lactate	−
m-Hydroxybenzoate	−
p-Hydroxybenzoate	−
Adipate	−
iso-Amylalcohol	+
2,3-Butandiol	−
1,2-Propandiol	−
Paraffin	+
Utilization as sole carbon and nitrogen sources	
Acetamide	−
L-Alanine	+
Proline	+
Serine	+
Production of:	
Catalase	+
Phosphatase	+
β-Galactosidase	+
β-Glucosidase	+
Nitrate reductase	−
Acid production from:	
L-Arabinose	+
D-Xylose	+
D-Glucose	+
D-Galactose	+
D-Fructose	+
L-Rhamnose	+
Lactose	+
Maltose	+
Raffinose	−
Trehalose	+
Sucrose	+
Cellobiose	+
Melezitose	−
myo-Inositol	+
Mannitol	+
D-Glucitol	−
Inulin	−
Ribitol	+

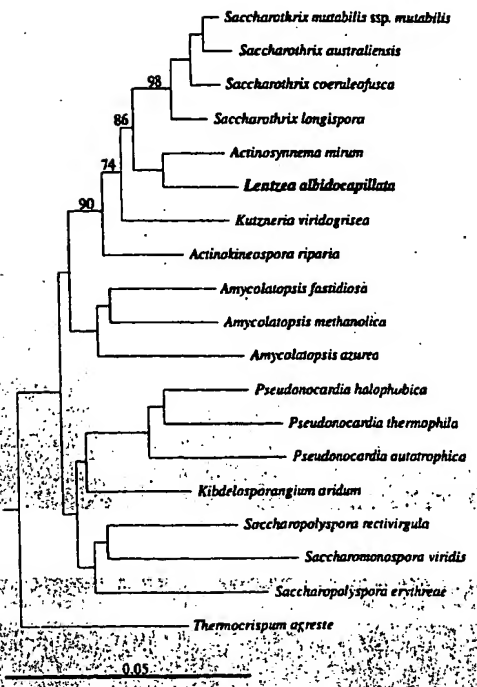

FIG. 2. Phylogenetic dendrogram showing the relationship of *L. albidocapillata* to members of the genera *Actinosynnema*, *Saccharothrix*, and *Kutzneria*. Scale bar = 5 nucleotide substitutions per 100 nucleotides.

adenine, guanine, hypoxanthine, xanthine, tyrosine, elastine, keratine, and testosterone (13), esculin decomposition (8), and casein and gelatin hydrolysis (12) were performed as described previously. The urea decomposition test was performed by using urea agar base (code CM 53; Oxoid) after 2.2% urea was added. The medium used in tests to determine utilization of carbon sources contained basal medium [1.5 g of KH_2PO_4 per liter, 0.5 g of $MgSO_4$ per liter, 0.1 g of $CaCl_2$ per liter, 5.0 g of $(NH_4)_2SO_4$ per liter, 0.5 g of KNO_3 per liter, 1,000 ml of distilled water], a trace salt solution, and a vitamin solution. The trace salt solution contained (per 1,000 ml of distilled water) 50.0 mg of H_3BO_3, 4.0 mg of $CuSO_4$, 10.0 mg of KI, 20.0 mg of $FeCl_3$, 40.0 mg of $MnSO_4$, and 40.0 mg of $ZnSO_4$, and the vitamin solution contained (per 100.0 ml of distilled water) 0.2 mg of biotin, 10.0 mg of calcium pantothenate, 10.0 mg of *p*-aminobenzoic acid, and 20.0 mg of thiamine hydrochloride. A 2-ml portion of the trace salt solution was added to 1 liter of basal medium, and the preparation was sterilized by autoclaving. After autoclaving the pH of the medium was adjusted to pH 7.2 with a sterile 0.1 N NaOH solution. Then a filter-sterilized solution containing a carbon source (final concentration, 0.02 M) and 0.1 ml of filter-sterilized vitamin solution per 100 ml were added aseptically. The medium was divided into 2-ml portions, placed in sterile tubes, and inoculated with bacteria.

The medium used in tests to determine simultaneous utilization of carbon and nitrogen sources was the same as the medium described above except that the basal medium contained (per liter of distilled water) 1.5 g of KH_2PO_4, 0.5 g of $MgSO_4$, and 0.1 g of $CaCl_2$.

The catalase production test was performed by mixing 1 loopful of a 1-week-old culture in glucose nutrient agar with 1 drop of freshly prepared 5% hydrogen peroxide. Phosphatase activity was determined as described previously (18). The release of *o*-nitrophenyl-β-D-galactopyranoside and the release of *p*-nitrophenyl-β-D-glucoside were used to assay β-galactosidase and β-glucosidase activities, respectively, by the method of Tsukamura (36). Nitrate reductase activity was determined as described previously (9). To determine sensitivity to lysozyme, a 0.05% (wt/vol) solution of lysozyme was sterilized by membrane filtration and added to autoclaved Czapeck Dox yeast extract-Casamino Acids broth (3) to a final concentration of 0.0025% (wt/vol). Small tubes containing medium with and without lysozyme were inoculated with 1 loopful of a 1-week-old culture and then examined for growth for up to 10 days. Growth in the control medium and growth in the test medium were regarded as positive results for lysozyme resistance (10). Tolerance to salt was determined by growing the organism on glucose nutrient agar and GYM agar plates supplemented with 0, 2, 4, 5, 6, 8, and 10% NaCl. The susceptibility of the organism to various antibiotics was studied by using the agar dilution technique; the results were determined microscopically as described previously (33). Various concentrations (0.20 to 128 μ/ml) of mezlocillin, amoxicillin plus clavulanic acid, cefotaxime, erythromycin, clindamycin, van-

TABLE 2. Levels of 16S rDNA similarity between *Lentzea albidocapillata* and related taxa

Species	% Similarity																				
	Lentzea albidocapillata	*Actinosynnema mirum*	*Saccharothrix longispora*	*Saccharothrix coeruleofusca*	*Saccharothrix australiensis*	*Saccharothrix mutabilis*	*Kutzneria viridogrisea*	*Actinokineospora riparia*	*Amycolanopsis fastidiosa*	*Amycolatopsis methanolica*	*Amycolatopsis azurea*	*Kibdelosporangium aridum*	*Pseudonocardia halophobica*	*Pseudonocardia thermophila*	*Pseudonocardia autotrophica*	*Saccharopolyspora rectivirgula*	*Saccharopolyspora viridis*	*Saccharopolyspora erythreae*
Actinosynnema mirum	97.1																	
Saccharothrix longispora	95.8	97.5																
Saccharothrix coeruleofusca	95.9	96.3	97.9															
Saccharothrix australiensis	95.3	95.7	97.6	98.4														
Saccharothrix mutabilis	96.0	96.3	98.0	98.7	99.0													
Kutzneria viridogrisea	95.8	95.9	95.6	96.0	94.9	95.6												
Actinokineospora riparia	94.8	95.6	96.4	95.8	95.7	95.8	95.9											
Amycolanopsis fastidiosa	93.7	94.0	94.5	94.1	93.5	94.0	93.6	95.1										
Amycolatopsis methanolica	92.9	94.1	94.9	94.0	93.3	93.7	94.0	95.0	95.6									
Amycolatopsis azurea	92.9	92.6	93.9	93.5	93.4	93.9	92.5	93.4	95.1	94.2								
Kibdelosporangium aridum	93.7	94.0	94.0	93.9	94.0	94.1	94.0	95.4	94.8	94.0	94.3							
Pseudonocardia halophobica	93.6	92.9	93.5	92.8	93.0	93.4	92.6	94.1	93.8	93.3	93.4	95.9						
Pseudonocardia thermophila	92.6	92.6	93.7	93.0	93.1	93.4	92.5	94.2	92.7	92.5	92.4	93.4	95.8					
Pseudonocardia autotrophica	92.5	92.6	92.9	92.4	91.8	92.6	92.6	93.5	93.2	93.3	92.7	93.6	95.2	94.1				
Saccharopolyspora rectivirgula	93.5	93.4	93.8	93.0	93.2	93.4	93.8	95.3	93.1	92.6	92.8	93.9	93.3	93.2	92.6			
Saccharopolyspora viridis	91.9	92.0	92.3	91.7	91.5	91.7	92.1	92.8	92.6	92.5	91.9	93.9	92.6	92.1	91.9	93.5		
Saccharopolyspora erythreae	92.9	93.1	93.0	92.7	92.6	93.0	92.7	93.2	92.9	92.1	93.8	94.1	92.6	92.5	92.9	93.9	92.4	
Thermocrispum agreste	92.1	92.1	92.0	92.3	92.3	92.6	92.4	93.1	93.0	93.2	92.5	93.3	93.0	92.1	92.5	92.8	92.0	92.3

comycin, aztreonam, gentamicin, imipenem, tetracycline, ciprofloxacin, amikacin, tobramycin, and ofloxacin were tested.

Cell chemistry. Whole-cell hydrolysates were analyzed to characterize amino acids and sugars as described previously (1, 21). Cellular fatty acid and mycolic acid methyl esters were prepared from whole-cell methanolysates (28, 29); the presence of both fatty acid and mycolic acid methyl esters was detected by thin-layer chromatography, and the fatty acid methyl ester profile was determined by gas chromatography-mass spectrometry. Menaquinones were extracted and purified as described previously (2), and the menaquinone composition was determined by using a Finnigan Mat 212 mass spectrometer. Phospholipids were extracted, purified, and characterized as described previously (39).

DNA isolation and characterization. DNA was isolated by the phenol method (31). Enzymatic hydrolysis with both RNase T_1 (Sigma) and RNase A (Sigma) was used to completely eliminate RNA from the DNA preparation. The G+C content of the DNA was determined by high-performance liquid chromatography (26).

16S rDNA sequence determination. Genomic DNA was extracted and PCR-mediated amplification of 16S ribosomal DNA (rDNA) genes was performed as described previously (30). Purified PCR products were directly sequenced by using a *Taq* DyeDeoxy terminator cycle sequencing kit (Applied Biosystems, Foster City, Calif.) according to the protocol provided by the manufacturer. An Applied Biosystems model 373A DNA sequencer was used for electrophoresis of the sequencing reaction mixtures.

The two sequences determined in this study were manually aligned with previously published sequences available from the public databases. Evolutionary distances calculated by the method of Jukes and Cantor (17) were used to construct a phylogenetic tree by the least-squares method of De Soete (5). Bootstrap values based on the results of an analysis of 1,000 trees were calculated by using the programs NJBOOT and NJFIND.

Nucleotide sequence accession numbers. The 16S rDNA sequences of *Actinosynnema mirum* and strain IMMIB D-958^T are available from the EMBL data library under accession numbers X84447 and X84321, respectively.

RESULTS

Micromorphology. Strain IMMIB D-958^T was gram positive and not acid fast. The vegetative hyphae were well developed with moderate irregular branching and penetrated the agar, forming compact colonies on the agar surface. The aerial mycelium was well developed and fragmented into rod-shaped elements (Fig. 1). Sporangia were not observed.

Cultural morphology. The vegetative mycelium on ISP medium 2, ISP medium 3, ISP medium 4, and GYM agar was yellow to yellowish brown. The aerial mycelium was white to whitish yellowish. Melanin pigment was not produced on either peptone-yeast extract-iron agar (ISP medium 6) or tyrosine agar (ISP medium 7).

Physiological characteristics. Hypoxanthine, tyrosine, casein, urea, esculin, and elastin were decomposed, but adenine, xanthine, gelatin, guanine, keratin, and testosterone were not decomposed (Table 1). Strain IMMIB D-958^T produced catalase, β-glucosidase, β-galactosidase, and phosphatase, but not nitrate reductase. L-Arabinose, xylose, glucose, galactose, rhamnose, lactose, maltose, trehalose, sucrose, cellobiose, ribitol, inositol, mannitol, gluconate, iso-amylalcohol, and paraffin were utilized as carbon sources but raffinose, melezitose, erythritol, glucitol, acetate, benzoate, citrate, lactate, *m*-hydroxybenzoate, *p*-hydroxybenzoate, adipate, 2,3-butandiol, and 1,2-propandiol were not utilized. Strain IMMIB D-958^T produced acid from arabinose, xylose, glucose, galactose, fructose, rhamnose, lactose, maltose, trehalose, sucrose, cellobiose, inositol, mannitol, and ribitol but not from raffinose, melezitose, glucitol, and inulin. It was resistant to lysozyme and tolerated NaCl at concentrations up to and including 4%. The following MICs were determined: mezlocillin, 64 μg/ml; amoxicillin plus clavulanic acid, 4 μg/ml; cefotaxime, 8 μg/ml; erythromycin, 4 μg/ml; clindamycin, 2 μg/ml; vancomycin, 4 μg/ml; gentamicin, 0.20 μg/ml; imipenem, 4.0 μg/ml; tetracycline, 0.20 μg/ml; ciprofloxacin, 1 μg/ml; amikacin, 1 μg/ml; tobramycin, ≤0.20 μg/ml; ofloxacin, 4 μg/ml; and aztreonam, >128 μg/ml.

Cell chemistry. The cell wall contained *meso*-diaminopimelic acid and no characteristic sugars (wall chemotype III). Mycolic acids were not detected. The fatty acid profile consisted of major amounts of straight-chain saturated, unsaturated, and branched-chain saturated fatty acids of the iso and anteiso types in addition to tuberculostearic acid (10Me-$C_{18:0}$). The phospholipid type was type PII sensu Lechevalier et al. (22); i.e., phosphatidylethanolamine was the characteristic phospholipid. Other phospholipids, including phosphatidylinositol, phosphatidylinositol mannoside, phosphatidylglycerol, and diphosphatidylglycerol, were also detected. The predomi-

nant menaquinone was MK-9; in addition, a trace amount of MK-9(H_2) was also present. The G+C content of the DNA was 68.6 mol%.

16S rDNA sequence analysis. The almost complete 16S rDNA sequences of strain IMMIB D-958^T and *Actinosynnema mirum* DSM 43827^T which we determined contained 1,438 and 1,460 nucleotides, respectively. A phylogenetic analysis revealed that both of these organisms are most closely related to members of the genera *Saccharothrix*, *Kutzneria*, and *Actinokineospora* (Fig. 2).

The 16S rDNA sequence of strain IMMIB D-958^T exhibited a high level of similarity (97.1%) to the *Actinosynnema mirum* sequence. We observed an equidistant relationship among strain IMMIB D-958^T, members of the genus *Saccharothrix*, and *Kutzneria viridogrisea* (levels of similarity 95.3 to 96.0%) (Table 2).

DISCUSSION

Several genera belonging to the order *Actinomycetales* are morphologically similar to the strain described in this paper because they also produce well-developed aerial hyphae. Nevertheless, strain IMMIB D-958^T can be distinguished by its unique morphological and chemotaxonomic profiles, which support the conclusion that this organism does not belong to any previously described genus (14, 19, 20, 24, 27, 35, 38) (Table 3). Although species belonging to the genera *Saccharothrix* (19) and *Amycolatopsis* (24) have a type PII phospholipid pattern (phosphatidylethanolamine is the characteristic phospholipid), they differ from strain IMMIB D-958^T in that members of the genus *Amycolatopsis* have type IV cell wall chemistry (i.e., *meso*-diaminopimelic acid in addition to galactose and arabinose) and members of the genus *Saccharothrix* have type III cell walls (i.e., *meso*-diaminopimelic acid, galactose, rhamnose, and mannose are the characteristic cell wall sugars). Both strain IMMIB D-958^T and members of the genus *Nocardiopsis* are wall chemotype III organisms (27); however, members of the genus *Nocardiopsis* produce a type PIII phospholipid pattern (phosphatidylcholine is the characteristic phospholipid) (Table 3). Strain IMMIB D-958^T differs from members of the genus *Pseudonocardia* (24, 38) in that members of the genus *Pseudonocardia* are cell wall chemotype IV and phospholipid type PIII organisms. Strain IMMIB D-958^T differs from members of the *Actinomadura* (20) in that members of the genus *Actinomadura* possess madurose as a characteristic whole-cell sugar and have hydrogenated menaquinones (Table 3). Strain IMMIB D-958^T is phenotypically most similar to members of the genera *Kutzneria* (35) and *Actinosynnema* (14). Members of the genera *Kutzneria* and *Actinosynnema* and strain IMMIB D-958^T all are wall chemotype III and phospholipid type II organisms and contain branched-chain fatty acids of the iso and anteiso types and tuberculostearic acid (10Me-$C_{18:0}$). However, differences in the wall sugars, menaquinone patterns, and whole-cell fatty acid profiles of these organisms, as well as the presence or absence of sporangia and/or motile spores (Table 4), support our suggestion that strain IMMIB D-958^T should be separated from the genera *Kutzneria* (35) and *Actinosynnema* (14). The results of our 16S rDNA sequence analysis revealed the relationship of strain IMMIB D-958^T to the genera *Actinosynnema*, *Kutzneria*, and *Saccharothrix*. The phylogenetic coherence of this cluster is supported by high bootstrap values, as well as the cell wall chemotype (chemotype III) found in these three genera. *Actinokineospora riparia*, a wall chemotype IV organism, is the deepest branch of this cluster.

The results of the 16S rDNA sequence analysis also indicate

TABLE 3. Chemotaxonomic characteristics of the genus *Lentzea* and other mycolateless actinomycete taxa

Taxon	Cell wall diamino acid[a]	Whole-cell sugar pattern	Cell wall chemotype[b]	Phospholipid type[c]	Phospholipids[d]	Predominant menaquinone(s)	Fatty acids[e]
Lentzea	*meso*-DAP	No characteristic sugar	III	P II	PE, DPG, PG, PI	MK-9	S, U, T, iso, anteiso
Actinomadura madurae	*meso*-DAP	Madurose	III	P I	PIM, PI, PG(v), DPG(v)	MK-9(H_4), MK-9(H_2), MK-9(H_4)	S, U, T, anteiso(v)
Actinomadura pusilla	*meso*-DAP	Madurose	III	PIV	GluNU, PE(v), PME(v), PI, DPG	MK-9, MK-10(H_4), MK-10(H_6)	S, U, T, iso(v), anteiso(v)
Nocardiopsis	*meso*-DAP	No characteristic sugar	III	PIII	PC, PE(v), PME(v), PG(v), PI	MK-10(H_4), MK-9(H_4), MK-9(H_6)	S, U, T
Sac. harzvhrix	*meso*-DAP	Galactose, rhamnose, mannose	III	P II	PE, PIM, PI, DPG, PG(v)	MK-10(H_4), MK-9(H_4)	S, U, iso, anteiso
Amycolatopsis	*meso*-DAP	Galactose, arabinose	IV	P II	PE, PIM, PI, DPG, PG(v)	MK-9(H_4), MK-8(H_4)	S, U, iso, anteiso
Pseudonocardia	*meso*-DAP	Galactose, arabinose	IV	PIII	PC, PE(v), PME(v), PG(v), PI, DPG(v)	MK-8(H_4)	S, U, T, iso, anteiso

[a] *meso*-DAP, *meso*-diaminopimelic acid.
[b] Cell wall chemotype as described by Lechevalier and Lechevalier (23).
[c] Phospholipid type as described by Lechevalier et al. (25).
[d] PE, phosphatidylethanolamine; DPG, diphosphatidylglycerol; PG, phosphatidylglycerol; PI, phosphatidylinositol; PIM, phosphatidylinositol mannosides; GluNU, unknown glucosamine-containing phospholipids; PME, phosphatidylmonomethylethanolamine; PC, phosphatidylcholine. A v in parentheses indicates that different amounts of the compound are present in different taxa.
[e] S, straight-chain fatty acids; U, monounsaturated fatty acids; T, tuberculostearic acid. A v in parentheses indicates that different amounts of the compounds are present in different taxa.

TABLE 4. Chemotaxonomic characteristics of strain IMMIB D-958^T and the actinomycete genera *Kutzneria* and *Actinosynnema*

Taxon	Cell wall diamino acid[a]	Whole-cell sugar pattern	Cell wall chemotype	Phospholipid type	Phospholipids[b]	Predominant menaquinone(s)	Fatty acids	Sporangia	Motile spores
IMMIB D-958^T	*meso*-DAP	No characteristic sugar	III	PII	PE, PI, PG, DPG	MK-9	anteiso-$C_{14:0}$, iso-$C_{14:0}$, *n*-$C_{14:0}$, iso-$C_{15:0}$, anteiso-$C_{15:0}$, *n*-$C_{15:0}$, iso-$C_{16:0}$, *n*-$C_{16:0}$, 10Me-$C_{16:0}$, iso-$C_{17:0}$, anteiso-$C_{17:0}$, *n*-$C_{17:0}$, iso-$C_{18:0}$, *n*-$C_{18:1}$, *n*-$C_{18:0}$, 10Me-$C_{18:0}$	Absent	Absent
Kutzneria	*meso*-DAP	No characteristic sugar[c]	III	PII	PE, PE-OH, PI, DPG	MK-9(H_4)	iso-$C_{15:0}$, *n*-$C_{15:0}$, iso-$C_{16:0}$, 2OH-iso-$C_{16:0}$, 10Me-$C_{16:0}$, iso-$C_{17:0}$, anteiso-$C_{17:0}$, 2OH-anteiso-$C_{17:0}$, *n*-$C_{17:0}$, *n*-$C_{17:1}$, 10Me-$C_{17:0}$, iso-$C_{18:0}$, *n*-$C_{18:0}$, 10Me-$C_{18:0}$	Present	Present
Actinosynnema	*meso*-DAP	No characteristic sugar[d]	III	PII	PE, PIM, PI, DPG	MK-9(H_4), MK-9(H_6)	Straight- and branched-chain fatty acids with major amounts of anteiso-$C_{17:0}$ and 10Me-$C_{18:0}$	Dome-like structure	Present

[a] *meso*-DAP, *meso*-diaminopimelic acid.
[b] PE, phosphatidylethanolamine; PI, phosphatidylinositol; PG, phosphatidylglycerol; DPG, diphosphatidylglycerol; PE-OH, hydroxyphosphatidylethanolamine; PIM, phosphatidylinositol mannosides.
[c] Different amounts of galactose and rhamnose are present in different members of the genus.
[d] Galactose and mannose are present.

that strain IMMIB D-958^T branched off between the genus *Kutzneria* and the genus *Actinosynnema*. On the basis f phylogenetic and phenotypic evidence, below we describe the new genus *Lentzea* t accommodate this strain; *Lentzea albidocapillata* DSM 44073 is the type strain of the type species of this genus. Formal descriptions of the genus and the type species are given below.

Description of *Lentzea* gen. nov. *Lentzea* Lent' ze. a. M. L. fem. n. *Lentzea*, named after Friedrich A. Lentze, a German microbiologist who devoted a considerable part of his life to studying pathogenic actinomycetes). Vegetative mycelia branch (diameter, approximately 0.5 to 0.7 μm); an aerial mycelium is produced and fragments into rod-shaped elements. Gram positive. Resistant to lysozyme. Catalase positive and aerobic. Type III cell wall composition (*meso*-diaminopimelic acid with no characteristic whole-cell sugars). Type PII phospholipid pattern with significant amounts of phosphatidylethanolamine. The principal menaquinone is MK-9; a trace amount of MK-9(H_2) is also present. The fatty acid profile consists of straight-chain saturated, unsaturated, and branched-chain saturated fatty acids of the iso and anteiso types in addition to tuberculostearic acid. The type species is *Lentzea albidocapillata*. Phylogenetically, the genus *Lentzea* represents a line of descent adjacent to the genus *Actinosynnema* and close to the genera *Saccharothrix* and *Kutzneria*.

Description of *Lentzea albidocapillata* sp. nov. *Lentzea albidocapillata* (al. bi. do. ca. pil. la' ta. L. adj. *albidus*, white; L. adj. *capillatus*, hairy; M. L. fem. adj. *albidocapillata*, white haired, referring to the abundant whitish aerial hyphae). The substrate mycelium is yellow to yellowish brown; the aerial mycelium is white to whitish yellow and fragments into rod-shaped elements. No soluble pigment is produced. Melanoid pigments are not produced on either ISP medium 6 or ISP medium 7. Hypoxanthine, tyrosine, casein, urea, esculin, and elastin are hydrolyzed; adenine, xanthine, gelatin, guanine, keratin, and testosterone are not hydrolyzed. Catalase, phosphatase, β-glucosidase, and β-galactosidase are produced; nitrate reductase is not produced. Growth occurs in the presence of 4% NaCl. Assimilates L-arabinose, xylose, glucose, galactose, rhamnose, lactose, maltose, trehalose, sucrose, cellobiose, ribitol, inositol, mannitol, gluconate, iso-amylalcohol, and paraffin, but not raffinose, melezitose, *meso*-erythritol, glucitol, acetate, benzoate, citrate, lactate, *m*-hydroxybenzoate, *p*-hydroxybenzoate, adipate, 2,3-butandiol, or 1,2-propandiol. Acid is produced from arabinose, xylose, glucose, galactose, fructose, rhamnose, lactose, maltose, trehalose, sucrose, cellobiose, inositol, mannitol, and ribitol; no acid is produced from raffinose, melezitose, or inulin. Growth occurs at 20, 30, and 37°C. No growth occurs at 42°C. The G+C content of the DNA of the type strain is 68.6 mol%. The type strain was isolated from a tissue specimen taken from an abdominal mass in a patient suffering from peritoneal carcinomatosis; it was isolated only once, so it is difficult at this time to determine the risk group to which the species belongs. The type strain of *L. albidocapillata* is strain DSM 44073.

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